

AMENDMENT TO THE CLAIMS

1. (Previously presented) A semiconductor device comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal,

oxygen, silicon and nitrogen,

wherein the lower barrier film is amorphous.

2. (Original) The semiconductor device according to claim 1, wherein

the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and

the upper barrier film contains the metal, oxygen and nitrogen.

3. (Original) The semiconductor device according to claim 1, wherein

$0.23 \leq y/(x+y) \leq 0.90$

when a composition of the high dielectric constant film is expressed as $M_xSi_yO_z$, where M, O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

4. (Original) The semiconductor device according to claim 1, wherein

$0.23 \leq y/(x+y) \leq 0.30$

when a composition of the high dielectric constant film is expressed as $M_xSi_yO_z$, where M , O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

5. (Currently amended) The semiconductor device according to claim 1, wherein

$$x/(x+y) \geq 0.10$$

when the metal is hafnium or zirconium, and

a composition of the lower barrier film is expressed as $[[M_xSi_yON]] M_xSi_yO_zN_w$, where M , O , Si and N represent the metal, oxygen, silicon and nitrogen, respectively, and $x > 0$ $[[and]]$, $y > 0$, $z > 0$ and $w > 0$.

6. (Original) The semiconductor device according to claim 1, wherein the gate electrode is a metal gate electrode.

7-31. (Canceled)

32. (Previously presented) The semiconductor device according to claim 1, wherein the lower barrier film is a silicon oxynitride film including the metal.

33. (Previously presented) The semiconductor device according to claim 1, wherein the high dielectric constant film contains nitrogen.

34. (Previously presented) The semiconductor device according to claim 1, wherein the high dielectric constant film is formed from a metal oxide ($M_xSi_yO_2$ (M is the metal, and $x > y > 0$)) containing silicon.

35. (Canceled)

36. (New) The semiconductor device according to claim 1, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and the upper barrier film contains the metal, oxygen, silicon and nitrogen.

37. (New) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal, oxygen, silicon and nitrogen, wherein

$$0.23 \leq y/(x+y) \leq 0.90$$

when a composition of the high dielectric constant film is expressed as M_xSi_yO , where M, O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

38. (New) The semiconductor device according to claim 37, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and the upper barrier film contains the metal, oxygen and nitrogen.

39. (New) The semiconductor device according to claim 37, wherein the gate insulating film comprises an upper barrier film formed above the high dielectric constant film, and the upper barrier film contains the metal, oxygen, silicon and nitrogen.

40. (New) The semiconductor device according to claim 37, wherein the gate electrode is a metal gate electrode.

41. (New) The semiconductor device according to claim 37, wherein the lower barrier film is a silicon oxynitride film including the metal.

42. (New) The semiconductor device according to claim 37, wherein the high dielectric constant film contains nitrogen.

43. (New) A semiconductor device, comprising:
a gate insulating film formed on a substrate; and
a gate electrode formed on the gate insulating film;
the gate insulating film comprising:
a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal, oxygen, silicon and nitrogen, wherein

$$0.23 \leq y/(x+y) \leq 0.30$$

when a composition of the high dielectric constant film is expressed as $M_xSi_yO_z$, where M, O and Si represent the metal, oxygen and silicon, respectively, and $x > 0$ and $y > 0$.

44. (New) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal, oxygen, silicon and nitrogen, wherein

$$x/(x+y) \geq 0.10$$

when the metal is hafnium or zirconium, and

a composition of the lower barrier film is expressed as $M_xSi_yO_zN_w$, where M, O, Si and N represent the metal, oxygen, silicon and nitrogen, respectively, and $x > 0$, $y > 0$, $z > 0$ and $w > 0$.

45. (New) A semiconductor device, comprising:

a gate insulating film formed on a substrate; and

a gate electrode formed on the gate insulating film;

the gate insulating film comprising:

a high dielectric constant film containing a metal, oxygen and silicon; and

a lower barrier film formed below the high dielectric constant film and containing the metal, oxygen, silicon and nitrogen, wherein

the high dielectric constant film is formed from a metal oxide ($M_xSi_yO_2$ (M is the metal, and $x > y > 0$)) containing silicon.